Complete Set of Proton Spin Observables in Field Elastic Scattering at 250 MeV

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One of the fundamental interests in nuclear physics is to establish nuclear forces and understand nuclear phenomena based on the fundamental Hamiltonian. Studies of few- nucleon systems offer a good opportunity to investigate these forces. In recent years it became possible to perform rigorous numerical Faddeev-type calculations for the 3N scattering processes by the tremendous advance in computational capabilities [1]. In addition to the first signal on 3NF effects resulting from discrete states [2], strong 3NF effects were observed in a study of the minima of the N*d* elastic scattering cross section at incoming nucleon energies higher than about 60 MeV [3]. On the other hand, a recent study at RIKEN [4] shows that the inclusion of the 3NF does not always improve the description of precise polarization data taken at intermediate deuteron energies. These results may be caused by a wrong spin structure of present-day 3NF's. Clearly the present situation is only the very beginning of the investigation of the spin structure of the 3NF.

At the Research Center for Nuclear Physics (RCNP) of Osaka University, the angular distributions of the cross section, the proton analyzing power and all proton polarization transfer coefficients of $\vec{p}$ d elastic scattering were measured at 250 MeV. These are the first measurements of a complete set of proton polarization observables for $\vec{p}$ d elastic scattering at intermediate energies. The present data are compared with theoretical predictions based on exact solutions of the three-nucleon Faddeev equations and modern realistic nucleon- nucleon potentials combined with three-nucleon forces, namely the Theson-Melbourne (TM) 2ir-exchange model [5], a modification thereof (TM') [6] closer to chiral symmetry, and the Urbana IX model [7].

References

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